MARS OBSERVER PMIRR: APPLICATIONS TO ATMOSPHERIC TRANSPORT.

R. W. Zurek and D. J. McCleese, Jet Propulsion Laboratory, California Institute of Technology, Pasadena CA 91109, USA.

The Pressure Modulator Infrared Radiometer (PMIRR) is an atmospheric sounder designed to observe temporal and spatial variations of water vapor and of dust suspended in the Mars atmosphere, to characterize the planetary-scale thermal structure and circulation of the atmosphere, and to quantify the polar radiative balance [1]. These measurements are fundamental to understanding the seasonal cycles of dust, of water, and of carbon dioxide on Mars and, in particular, to determining the role of atmospheric transport. Using measurements in eight narrow-band infrared spectral regions and one broadband visible channel, the PMIRR investigation teams at JPL and Oxford University will derive vertical profiles of atmospheric temperature, extinction due to suspended dust, and water vapor concentration, as well as locations of C02 and H20 ice clouds. These data will be used in a variety of ways to address issues of atmospheric dynamics and transport.

Three topics will be emphasized in this talk: 1) the expected precision of the retrieved profiles of temperature, dust extinction, and water vapor, including plans for validating the profiles; 2) the observational strategy, designed to best use PMIRR's two-axis scan mirror, as deployed in the Mars Observer mapping orbit; and 3) approaches to mapping the atmospheric fields globally and the derivation of key meteorological fields related to estimating atmospheric transport.

The underlying philosophy of the observing strategy is to map the atmospheric fields as continuously and as systematically as possible, since much of what we want to learn comes from observing variations with both space and time. Changes in the mapping strategy as a function of season (with a planet-encircling dust storm counted as a "seasonal" event) will be discussed. The individual vertical profiles will be mapped using different algorithms to provide synoptic global fields of temperature, of dust and, where possible, of water vapor. These mapped fields can be used to derive directly estimates of wind shear and of radiative forcing; they and/or the retrieved vertical profiles will also be provided to several groups for assimilation of the retrieved fields into data-model blends that will provide estimates of the meteorological fields, including fields that cannot be derived directly (e.g., reference level winds and vertical velocities). While such data assimilation techniques can, in principle, provide "optimal" estimates of the fields, there are many issues yet to be resolved, including proper characterization of observational errors and of deficiencies in the dynamical models.

1. McCleese, D. J., Haskins, R. D., Schofield, J. T., Zurek, R. W., Leovy, C. B., Paige, D. A. and Taylor, F. W. (1992) JGR, 97,7735-7,757.